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The Influence of Ambient Noise on Creative Cognition and Behavior

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Across four studies, we study the effect of moderate versus low levels of ambient noise (70 dB versus 50 dB) on creative performance. We demonstrate that constraining noise to be moderate (versus low) induces processing difficulty and greater abstract processing, which then leads to heightened creativity.

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Constraining the Consumption Environment to Enhance Consumer Creativity

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EXTENDED ABSTRACTS

“The Influence of Ambient Noise on Creative Cognition and Behavior”

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Recent years have seen a rapid shift in consumer markets from being product- and firm-centric to one encouraging consumer involvement in mutual value creation by leveraging consumer creativity (Prahalad and Ramaswamy 2004). In parallel, there has been a surge in research studying various aspects of consumer creativity, such as consumer created content (e.g., Moreau and Herd 2010) and the effects of constraints on consumer creativity (Moreau and Dahl 2009). Our research builds on this research by exploring the effects of an important environmental variable on consumers' creative performance. It is well accepted that consumers' physical surroundings can significantly affect their decisions, whether it is color, aesthetics or ambient scents. We focus on one aspect of physical surroundings that has received less attention – ambient noise.

Although ambient noise is always present in consumption contexts, its effects on cognition and behavior are not well-understood. Our research contributes to this literature by exploring the underlying process through which noise may affect creative cognition. Specifically, we examine how different levels of background noise may affect consumer creativity and behavior.

We propose that moderate compared to low levels of noise can actually enhance creativity. Based on prior research (e.g., Nagar and Pandey 1987), we theorize that a higher noise level distracts individuals and increases processing difficulty, which causes individuals to process more abstractly (Alter and Oppenheimer 2008). Because empirical work on construal level has shown that abstract construal enhances creative performance (e.g., Smith 1995), we hypothesize that a moderate level of ambient noise may increase processing difficulty, activate an abstract construal level, which subsequently may enhance creativity. Our experiments provide systematic support to our theorizing.

In our research, we only use moderate (70 dB) and low (50 dB) levels of noise intensity. Although prior research has also used high noise levels (e.g., 95 dB, Nagar and Pandey 1987), such high intensity is (1) unlikely to be sustainable in a consumer environment and (2) has constantly shown negative effects across various studies and variety of tasks (e.g., Nagar and Pandey 1987). Consequently, high noise levels were excluded from our study. In addition to intensity, different types of noises have been used in past research, such as white noise, pink noise, jet engine noises, and incessant ringing of alarm clocks. In the present research, we blend a combination of different types of ambient noises to create a soundtrack of constantly varying background noise.

In Study 1, we test our main hypothesis that a moderate (vs. low) level of noise can enhance performance on a creative task. We used Remote Associates Tests as our focal task to measure creativity. Results showed that respondents in the moderate noise condition performed significantly better on Remote Associate Tests compared to respondents in the low noise condition. Study 2 tests our central thesis in a more consumer relevant context. It examines whether a moderate (vs. low) level of noise enhances persuasion when a persuasive message requires creative cognition to comprehend. Results again support our theorizing.

In Study 3 we test our proposition that alternative levels of noise affect the two key dimensions of creativity identified in prior research—novelty and appropriateness—such that a moderate level of noise would enhance both dimensions. In this study, we presented our participants with a dilemma problem and asked them to generate as many solutions as they could think of. In addition, to test the underlying process proposed earlier, we measured processing difficulty and construal level as participants completed the survey. All generated ideas were rated along the novelty and appropriateness dimensions by a separate set of 14 judges each. As hypothesized, ideas generated by those in the moderate (vs. low) noise condition were judged to be significantly higher on both the novelty and appropriateness dimensions. The multiple mediation analysis provided support to our theorizing by demonstrating that a moderate level of noise enhanced processing difficulty which in turn induced a higher construal level, consequently leading to higher ratings on both novelty and appropriateness.

In Study 4, we examine how noise affects individuals' acceptance of creative, innovative products. In our first three studies, we manipulated noise at two levels. However, in real life, consumers come across a wide range of noise intensities. Thus, we conducted this study in a student lounge area and measured ambient noise level when the study sessions were run. Regression analysis revealed that as noise level increased, respondents reported a higher willingness-to-buy for innovative products, that is, they were more likely to accept these products.

“Restricting Choice of Inputs Increases Creativity for Experienced Consumers”

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Our research explores the influence of input choice set on both consumers' self-perceptions and actual realization of creative output. It questions whether increasing choice of creative inputs (e.g., offering more choice of ingredients for a cook) leads to more creative outcomes.

Theoretically, because increasing choice of inputs offers increasing solution spaces, more choice should increase the likelihood that a more creative solution is produced. Previous investigations support this notion, finding that sufficient input choice plays a positive role in achieving creative outcomes (e.g., Amabile and Gitomer 1984). Consistent with such findings, suppliers of creative inputs (e.g., art stores) display choice options on entire walls; the implicit assumption being that more choice helps when people are selecting inputs for a creative task. Most consumers also believe that more choice is better (Schwartz 2004). It follows that consumers being provided with extensive rather than limited choice of creative inputs should feel more creative (H1).

Focusing on actual creativity, however, we challenge this lay belief to propose that increasing choice hurts creativity. In particular, we test the critical role of input choice in shaping creativity for consumers who are experienced in a creative task. In doing so, we primarily draw on the choice overload literature (e.g., Iyengar and Lepper 2000; Schwartz 2004) to test the prediction that input choice has a debilitating effect on experienced consumers' actual creativity, when compared to consumers with limited experience in the creative task (H2). The more choice a consumer has, the less constrained s/he is, and the more likely it is that s/he will retrieve an existing solution to the problem under study (e.g., Park and Smith 1989), thereby sticking to the top-down process described

as the “path-of-least-resistance” (POLR, Ward 1994), which leads consumers to adopt a less rather than more creative solution. This adverse effect of choice should only apply to experienced consumers, since they have the domain-relevant skills allowing them to identify the vast number of possible creative solutions in the choice space (Amabile 1983). In contrast, inexperienced consumers are unlikely to be sensitive to a change in the input choice set, and should merely display a general tendency to stick to the POLR. In sum, restricting choice should positively affect creativity for experienced consumers, and have no impact on inexperienced consumers.

Further, we identify that a decrease in enjoyment with the creative process causes the debilitating effect of choice (H3). Too much choice has been linked to decision-making paralysis, and generally found to be detrimental to consumers’ emotional well-being, particularly when consumers do not know *a priori* exactly what they want (Schwartz 2004), as is the case with creative outcomes. Restricting choice in creative consumption contexts should be conducive to a more enjoyable and playful creative experience, which in turn should transcend into the creative outcome (e.g., Isen 1999). Again, this positive experience should only affect experienced consumers, for only they are affected by the daunting vastness of creative possibilities.

We tested our predictions in a field study, in which 76 experienced and inexperienced knitters (mean age=29.82 years) created a scarf over a week, after choosing yarn from a limited (6 colors) versus a relatively extensive (12 colors) choice set. At the end of the week, participants returned their completed scarf, reported how creative they thought their scarf was and assessed how pleasant the creative process had been. After all scarves were collected, two experts in creative knitting evaluated the creativity of the scarves (randomized order) through handling and inspection.

Our key findings are that, focusing on the knitters’ self-reported measure of creativity, knitters rated their own scarf as less creative under limited rather than extensive choice, in support of H1. In contrast, the averaged knitting experts’ creativity ratings (Pearson- $r=.66$, $p<.01$) revealed a very different pattern when it was subjected to a Choice x Knitting level ANOVA. As predicted, we found a significant Choice x Knitting level interaction, $F(1, 72)=7.75$, $p<.007$, $r^2=.10$. In support of H2, the analysis of simple effects further revealed that scarves knit by experienced knitters under limited rather than extensive choice were significantly more creative. Scarves knit by inexperienced knitters were equally creative under limited and extensive choice, $t<1$. Finally, in support of H3, we found that the averaged measures of knitters’ enjoyment mediated the knitting experts’ creativity ratings. Of particular interest, a limited choice made the task more enjoyable for experienced knitters, and that enjoyment led to more objectively rated creativity. We discuss these key findings, as well as other measures further supporting our conceptualization.

“Designing Memories”

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While constraints can be beneficial, they also have the potential to diminish perceived autonomy during a creative activity. Finding the right balance between structure and freedom in any given creative activity is, therefore, challenging. This research examines an important factor likely to influence where that optimal balance lies. Specifically, we investigate how the purpose for which the creative task is performed influences consumers’ creative experiences and evaluations of the creative product. In two studies, we engage participants in creative tasks (customizing a storage box, creating a scrapbook page) during which we either manipulate (Study 1) or

measure (Study 2) the extent to which the created product is intended to hold/capture something special. Both studies demonstrate that constraints have a positive influence on participants’ experiences and product evaluations when the purpose of the product is less special. When the purpose is special, however, constraints do not have a positive influence on either measure.

In Study 1, 100 female participants were told that they would be choosing design options for a box, which would then be assembled to their specifications. Two factors were manipulated between-participants: (1) the purpose of the box (functional: “storage box” vs. special: “memory box”) and (2) the constraints operating (low vs. high). Upon arriving, participants in the “functional” condition were asked to think about and describe the items they would place in the storage box. Participants in the “special” condition did the same for the memory box.

All participants were given an order form showing a drawing of a plain box indicating all the choices they could make in the customization task. They were then given a packet containing the second manipulation. Participants made 7 design choices. In the “low constraint” condition, the options were arranged in the packet according to the choices they would have to make. (e.g., the wide ribbon on the lid was Option A, and this condition showed all the “A” options on one page). In the “high constraint” condition, the options were presented in eight coordinated arrangements in which all seven customization decisions had already been made. Participants were told that these were merely suggestions, but creating an entirely unique design in this condition required more effort as participants had to search across pages to see all of their options.

Results showed that participants designing storage boxes had a more positive experience than those designing memory boxes. We also found an interaction, such that under high constraints, participants designing storage boxes reported more positive experiences than those designing memory boxes. When low constraints were in place, participants’ experiences did not depend on the box’s purpose. There was also a main effect of the box’s purpose on expectations, such that participants designing storage boxes reported higher expectations than those designing memory boxes. An interaction also emerged: High constraints produced higher expectations for storage boxes than for memory boxes. Under low constraints, expectations did not depend on the box type.

Study 2 was a 2-part study, with 73 female participants. In the first session, participants were given a packet in which they were asked to either (1) think back 4 weeks (“past”) or (2) think forward 4 weeks (“future”) and to describe (on paper) an experience/event that was (or was expected to be) particularly meaningful, fun, or positive. Participants then indicated how special that event was (or was expected to be). Next, they were they asked to create a scrapbook page capturing that event. All scrapbooking materials were held constant. Participants evaluated their scrapbook pages and left them with us until the second session, 4 weeks later. At that time, participants in both conditions described and evaluated the event their scrapbook page again.

Participants scrapbooking an event that had already occurred were more constrained because the details of the event were fixed (e.g., pictures were or were not taken). Participants scrapbooking a future event could control, to some degree, the details of the event to come. Regression was used to assess the effects of the time manipulation and the measured specialness of the event on evaluations of the scrapbook page. An interaction emerged ($F(1, 73)=5.02$, $p<.05$), and a spotlight analysis was used to interpret the results. Those scrapbooking a past event (high constraints) reported higher evaluations of their pages when the event was less special. For those scrapbooking a future event (low constraints), the pattern

was reversed. These findings are similar to those observed in Study 1, demonstrating that the specialness of the purpose of a creative activity moderates the effectiveness of constraints.

"The Blank Page: How Constraining the Creative Task Influences Creative Processes and Outcomes"

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Freedom and choice are often associated with creativity. Findings from creativity research can be seen as supporting this association, showing that constraints on freedom such as surveillance and a lack of choice can decrease the intrinsic motivation to create (Amabile & Gitomer, 1984; Amabile, 1983). In seeming opposition, decision making research has revealed a "Paradox of Choice" (Schwartz, 2004) in that too much choice can be paralyzing and tends to undermine good judgment and intrinsic motivation (Iyengar & Lepper, 2000). Given that judgment and choice are important, but often-overlooked aspects of creativity, the extent of choice available to a creator regarding which problems to solve and which solutions to consider may have a major impact on the creative process and subsequent outcomes.

This research uses a multi-method approach to examine how constraining a creative task affects creative processes and outcomes. Creative tasks are characterized as more or less constrained, depending the size of the search space the creator is permitted or opts to explore. A search space is bound by constraints that limit the range of options available, and that direct the creator towards certain options over others. In practical terms, such constraints limit the range of problems that may be solved, as well as the range of solutions considered.

Three studies examined the effects of constraint on the creative task where constraint is conceptualized as a continuum. Study 1 was a laboratory experiment centered around a written product design task. First, participants were given a prompt instructing them to do internet research and then use their research to design a product to address some health-related problem. Constraint was manipulated by varying the degree of choice the participant had in defining that problem: The low constraint group could address any health-related issue; the low-moderate constraint group could address any one of five specific health-related issues, the high-moderate, one of three; and the high constraint group was given one specific issue to address. All four groups were given access to the same database of articles for their research, and their search behavior was tracked unobtrusively. All groups had 40 minutes to allocate as they wished between research and writing the product proposal. Proposal creativity was rated using the consensual assessment technique (Amabile, 1983).

Results showed a curvilinear effect of constraint on creativity, such that both the low-moderate and high-moderate constraint groups' product proposals were rated as more creative than either the low or high constraint groups. These effects were not accounted for by alternative explanations such as time allocation during the task, or decreased intrinsic motivation. Analysis of the internet research data found differences in search behavior across groups in search behavior. Specifically, the two moderate constraint groups ran fewer unique searches in the database, spending more time with each search result than either the high or low constraint groups. This suggests that moderate constraint leads to a deeper engagement with new information, and greater certainty about the appropriateness of creative search strategies.

Studies 2 and 3 were field studies that examined the role of constraint in 43 new product development teams. In Study 2, constraint was measured rather than operationalized. Raters scored the limiting aspect of constraint by responding to the question, "What

percentage of possible ideas have been eliminated in solving the problem, or the types of solutions that address the problem" on a scale of 1-100%. Higher scores meant the project was more constrained (a greater percentage of all possible ideas being eliminated ex-ante) by virtue of the mission statement sentence. Inter-rater reliability was high (ICC=.80). Raters scored the directing aspect of constraint by responding to the question, "How constrained is the solution the team is trying to make" (ICC=.75). Each team submitted a mission statement for their new product, and two trained raters coded the content from these statements. Through quantitative analysis, Study 2 found that the degree of constraint that new product development teams voluntarily imposed on their projects at the beginning of the semester predicted the creativity of their product proposals more than ten weeks later. The results held up even when controlling for task conflict.

For Study 3, all 43 teams were ranked according to their constraint score as in Study 2 and sorted into high, moderate, and low constraint groups. One team was selected from each group based on the information richness of the data available, and was subjected to case study analysis using interview, observation, and archival data. We examined the data for these three teams. The result was a novel framework conceptualizing creativity as a hypothesis-testing activity.

These three studies suggest that while some amount of choice is important for encouraging creativity, too much can be counter-productive.

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